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# Responding to the Multifaceted COVID-19 Crisis: The Case of Mumbai, India

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**Abstract:** COVID-19 has severely impacted the society not only in terms of health but also in terms of economic survival of individuals. Unless adequate support is provided, the pandemic will have long-lasting effects, especially on the lives of the most vulnerable, often working in the informal sector. In this article, we present a case study drawing on systems thinking and complexity theory, outlining how the city of Mumbai has responded to COVID-19. We find a multifaceted scenario where non-profit organizations, businesses and citizen volunteers operate alongside government bodies to support Mumbai's population to overcome this pandemic. We provide broader policy lessons, as well as more specific lessons in relation to particular actors, from the first wave of the pandemic stressing the importance of becoming 'systems thinkers' and highlighting the importance of forming new partnerships and exploring new modes of knowledge sharing to effectively respond to crises.

**Key words:** COVID-19, crisis management, systems thinking, complexity, India

## I. Introduction

The COVID-19 pandemic is unprecedented and different from any other crises we have experienced in recent history. This pandemic has hit the most vulnerable individuals in developing countries hardest not only in terms of their health but also in terms of their economic survival, especially in India with 276 million people living below US$1.25 per day (World Bank, 2015). If not supported adequately by relevant government bodies, non-profit organizations (NPOs) and others, these individuals will experience long-lasting and devastating side effects of the COVID-19 crisis that go beyond health impacts. In this article, we present a case study outlining Maharashtra state's response with a focus on Mumbai, drawing on government documents,



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newspaper articles and 'lived experience', to provide broader lessons as to how different organizations can work together most effectively in responding to pandemics or other types of crises. Given the complexities of the COVID-19 pandemic, we use a systems thinking approach to grapple with the numerous interrelated factors that shape the response to this crisis.

Unlike any other event before, COVID-19 has demonstrated that decisions made to deal with one crisis, that is, COVID-19, may lead to other secondary and tertiary crises. Many commentators of the pandemic recognize that governments need to take urgent action to tackle COVID-19 such as imposing strict lockdown measures, but these decisions will have an effect on many other aspects of our lives; for example, the United Nations (2020) are expecting an additional 71 million people to be living in extreme poverty due to the COVID-19 pandemic, with South Asia and sub-Saharan Africa being particularly badly affected (p. 24). Already fragile health systems will be further eroded due to COVID-19 and improvements in maternal and child health will be reversed; for example, the under-5 mortality rate per month could increase from 35% to 44.8% with maternal death per month rising from 30.3% to 38.6% (United Nations, 2020). Oxfam (2020) highlights that by the end of 2020, more than 12,000 people per day could die from hunger which may potentially be more than those dying from COVID-19. These examples illustrate that decisions made by governments to tackle COVID-19 have wide consequences—some of these consequences can be seen immediately, while others will take time to emerge. At the same time, the pandemic and its consequences are not unfolding in a linear manner. Governments are faced with multi-layered and complex scenarios that are shaped by multiple competing issues as well as continuously changing and evolving dynamics. Taking into consideration a systems view in the analysis and decision-making process can help governments to better understand the causes and effects of the decisions they are taking because of the systemic and complex nature of the pandemic. Hence, we apply a systems lens to be able to better understand the multitude of connected factors that play a role in the context of COVID-19 in the Indian context, which need to be understood in order to be able to succeed in providing integrated policy solutions to this crisis.

We recognize that the pandemic is far from over and the situation in India is fluid with rapid and dramatic developments occurring almost daily. We chose to focus on a specific time period during the first wave for the purpose of developing a coherent narrative allowing us to reflect on the response to COVID-19. Therefore, we draw on the experience of Mumbai during the first wave of the pandemic, dated 11 March to 9 September 2020, to illustrate how a systems thinking approach could support the decision-making process in the context of a pandemic. Much of Mumbai's economy is dominated by informal sector workers with many micro- and small enterprises providing livelihood opportunities to the poor. The informal sector is particularly vulnerable to crises, with many of the poor having seen dramatic losses of incomes (Malik et al., 2020) as jobs and markets vanished overnight following the tough lockdown measures imposed by the Government of India (GoI) on 24 March 2020. The shutting down of economic activity, a loss of income for already very poor and vulnerable populations, a large number of migrant labourers unable to return home and COVID-19 cases steadily increasing combined to pose enormous challenges for local, state and national government bodies.

Mumbai is located in the state of Maharashtra which has been the hardest hit state in India in terms of COVID-19 infection rates. As of 9 September 2020, Maharashtra had 924,000 cases (21% of India's current total number of cases) and 27,027 deaths. Within Maharashtra, the vast majority of cases in the first wave were found in and around Greater Mumbai, including in large and densely

populated informal settlements where a large number of the migrant labourers that come to the city in search of work, stay. Mumbai makes an interesting case study not only because of the current crisis and the state government's active crisis leadership but also because of its long history of crisis management dating back to the early 19th century when it was faced with cholera, plague and flu pandemics as well as famines and frequent droughts.

In this article, we first set out our theoretical framework along with our methodological approach before presenting the case study material which consists of a short history of pandemics in the state of Maharashtra to provide the backdrop to the context of Mumbai, followed by an account of how the pandemic unfolded and evolved in Mumbai itself. We then discuss the impact it has had on the city and its inhabitants (in terms of health, livelihoods and economic survival) and provide a detailed description of the complex challenges local, state and central government bodies faced before outlining how they and other non-governmental actors responded to this pandemic. We find a multifaceted scenario where NPOs, businesses and citizens operate alongside local, state and central government to support marginalized individuals affected by the crisis. In the conclusion, we aim to provide specific lessons in relation to particular groups such as different government entities within Mumbai and NPOs that may be of value to cope with subsequent waves of the pandemic.

## II. Theoretical Implications: Systems Thinking and Complexity Theory

Recognizing the complexities of the COVID-19 pandemic, we employ a systems thinking approach drawing on elements of complexity theory to unpack the various interrelated factors underlying the successful management of crises. We attempt to capture the various notions of complexity and interdependence as this allows us to visualize the various cause and effect relationships. We use complexity and systems literatures to create a conceptual framework that guides our understanding of the multiple dimensions of the COVID-19 crisis in Mumbai.

COVID-19 has brought to the fore that systems thinking is crucially important to making better decisions in a complex and nonlinear world (Ramalingam, 2013; Ramalingam et al., 2020). Studying the pandemic from a complex systems approach allows us to consider the multiple interlinked and sometimes unexpected changes and outcomes which in turn provide us with pointers as to how best to deal with complex and systemic challenges and, ultimately, build a more resilient system.

Using a systems perspective broadens the analysis of a complex system by recognizing that actors and their interactions are influenced by institutions, thus affecting process change (or the evolution of and response to a crisis) (HM Treasury, 2020; Mytelka, 2000; Ramalingam, 2013; Ramalingam et al., 2008, 2020). Roles of actors and their relationships often evolve over time. Therefore, the system needs to be flexible enough to evolve with the changing requirements of new networks and partnerships.

## III. On Complex Systems

The literature on systems and complexity suggests that change (whether a crisis or other change) emerges and evolves in a non-linear way with actors (organizations and or individuals) playing a central role. Their interactions, knowledge exchanges and feedback loops are in turn conditioned by institutions (Birney, 2017; Freeman, 1987; Lundvall, 1992; Mytelka, 2000; Ramalingam et al., 2008). Figure 1 shows the centrality of actors, their interactions and knowledge flows within a complex system; it also presents how the multiple actors can shape the different components that form a particular system.

### *1 A System Is Complex and Evolutionary*

The system changes shape and structure over time as different actors group and regroup in different ways in response to external and

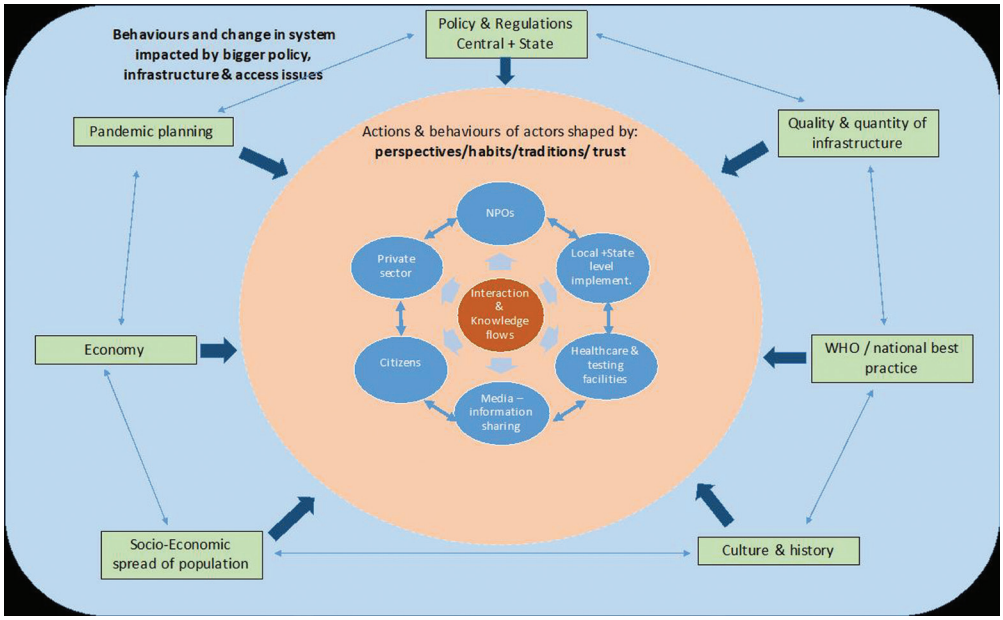


**Figure 1.** Complex System and COVID-19

**Source:** The authors (adapted from Mytelka, 2000).

internal factors that influence their behaviour. Therefore, complex systems see continuous change as actors, processes, dynamics and the system itself change over time. Systems thinking recognizes that the world is characterized by complexity and interrelatedness (Barbrook-Johnson et al., 2020; Glouberman and Zimmerman, 2002; Kurtz and Snowden, 2003; Ramalingam, 2013; Ramalingam et al., 2008). Actors and processes within the system are interconnected and interdependent, but as noted above, change in a system does not take place in a linear manner. Because of the interconnectedness and the non-linearity of systems, behaviour of the system and the outcome and change of the system, based on the interactions of its elements, can be unpredictable and disproportionate (Ramalingam, 2013). The pandemic mirrors this in the way it has evolved resulting in crises that were initially not predicted, such as the migrant crisis.

**Actors of different kinds interact** within the system (Mytelka, 2000; Ramalingam, 2013; Ramalingam et al., 2008). As in the case of this pandemic, these actors may include entrepreneurs; private businesses; NPOs representing civil society; government actors at the local, state and national levels; the traditional and social media; and so on. The different actors interact and share information, learn from each other and react to changes in the system.

In terms of **networks and partnerships**, these grow out of shared values and trust built over a period of time. Because of the importance of personal networks, individuals rather than organizations often play a vital role. Creating links (through networks) between actors is vital so that knowledge and information[1] flows through the system. The most effective partnerships are those consisting of stakeholders with different levels of knowledge and capabilities so that each can provide something new to the others.

Systems and their networks of actors are likely to be denser at the core and less dense at the periphery (Borgatti and Everett, 2000;

Ramalingam, 2013). Actors embedded in the denser core of the system, including their networks, may be more entrenched, more bureaucratic and less nimble than those at the periphery. Yet, their impact over time may become deeper and more far-reaching. However, this in turn makes them less able to respond and adapt quickly to new changes and challenges. A reason for this difficulty in responding quickly may be path dependence, whereby history and previous actions influence the way actors engage with new situations (Cowan and Gunby, 1996; Cowan et al., 2000). Actors at the periphery on the other hand may have fewer entrenched behaviours and dense networks or path dependence to fall back on, but they are able to regroup and react faster. During the pandemic, for example, governments that are at the core of the system had taken longer to implement new decisions, even though these had subsequently large impacts, while NPOs and individual citizen groups that are at the periphery of the system were able to act faster as less bureaucratically entrenched but with smaller impacts.

Given the different abilities to respond, networks and partnerships elicited different responses according to their location in the system, that is, faster and less impactful responses by actors located at the periphery of the system and slower but more impactful responses by the actors located at the core.

Another important aspect of systems is **knowledge and information sharing** which happens through interactions between actors within the system, providing the basis for learning and knowledge creation (Mytelka, 2000; Lundvall, 1992; Ramalingam, 2013; Ramalingam et al., 2008). Given the central role of accessing and adopting new knowledge and information, critical reflection, functioning feedback loops and learning are important so that actors can adjust to new challenges or improve the way they are dealing with existing ones as new knowledge becomes available. Feedback loops and processes (as represented in Figure 1 by the solid blue arrows in the central circle) shape how elements and dynamics in the system change and emerge.

Learning and feedback loops are important to improving existing knowledge to better manage crises and or to avoid mistakes; that is, constant feedback sharing among actors within a system can lead to the development of best practices with the aim to contain the spread of the virus during a pandemic. However, feedback loops can also have a negative impact; they can reinforce entrenched behaviour and lead to scare mongering or sharing of false information. During the pandemic, for example, traditional and social media have had mixed effects in this regard, both amplified important information and knowledge sharing, but they also contributed to fear and fake news. Feedback loops that are ineffective and slow can result in the slow implementation of new directives at the grassroots level, such as raising awareness among citizens and the police regarding what kind of shops may be allowed to remain open, or for what reasons citizens may move about in public.

Finally, **hard and soft institutions** are an integral part of any system; they govern the way actors and processes behave in the system (David, 1994; Lundvall, 1992; Ramalingam, 2013). Hard institutions refer to rules and regulations of a country and or region. Soft institutions refer to the habits and practices informed by tradition, culture and history. Trust which is governed by soft institutions is also crucially important, but it often takes time to build up. These institutions shape how actors and processes respond within a system. They also influence the characteristics and conditions of a particular system and the behaviour of actors within it. This in turn affects local decision-making processes and the handling of a crisis as well as how a crisis unfolds. In short, context matters. During the pandemic, we have seen this play out in how different countries have chosen to manage the crisis, and how the citizens have responded.

We have developed Figure 1 to summarize such a complex system in the context of

this pandemic. The boundary of this system is the region that we look at, in this case Mumbai. Outside the system, we find macro-level influences that shape the policies and regulations of the central, state and local governments such as pandemic preparedness; quality and quantity of infrastructure; adoption of best practices as shared by national and international bodies (e.g., The World Health Organization); the structure of the economy; the socio-economic spread of the population and the culture; and history that informs habits, practices and behaviours of the various actors involved in the system.

In summary, this complex system comprises of a range of different actors involved in the pandemic relief efforts including government, non-profit, private and healthcare sectors, as well as concerned citizens and the media. Networks and partnerships allow actors to interact, build relationships and share knowledge and information that are key to learning, feedback and quick response, reaction and adaptation to new challenges and situations that emerge as the pandemic evolves. The information sharing and feedback loops can lead to positive change by allowing quick reactions to new information from the ground. However, they can also reinforce entrenched behaviour, such as organizations operating the way they always have been, thus not allowing them to adapt with sufficient speed to a pandemic or crisis situation of this scale. Finally, institutions (hard and soft) are key as they influence the way actors behave and react.

## IV. Methods: An Evolutionary Case Study Approach

As COVID-19 is an ongoing crisis, primary data collection may be inappropriate, as it would distract key individuals from their work when they are most needed; instead, we use an evolutionary case study approach drawing on government documents, social media posts and newspaper articles complemented by historical analysis of state-level information focussing on the time period from 11 March to 9 September 2020. Key concepts of evolutionary economics have inspired the choice of our methodological approach. Evolutionary economics sees evolution as a non-directed, step-by-step process that lacks a specific goal or endpoint—a view that borrows from Darwin's view on how species evolved—and is largely concerned with understanding dynamics and change of phenomena in our society (Hodgson, 2003; Nelson, 2009). This approach allows us to examine how the multi-actor's response to the COVID-19 pandemic in Mumbai has evolved over the first 100 days and to explore how these reactions have been informed by India's historical and evolutionary path.

Furthermore, we also draw on 'lived experience' (Given, 2008) as a key cornerstone of our case study to better understand the complex interactions taking place between the range of actors involved in tackling the pandemic to tease out what these actors do and how their choices, habits and traditions interact dynamically within the broader system. We include 'lived experience' as an additional methodological choice as it nicely complements our evolutionary case study approach and allows us to apply the core components of our conceptual framework. 'Lived experience' has its roots in qualitative phenomenological research (e.g., Dahlberg and Dahlberg, 2003; Dowling and Cooney, 2012) and is a concept that has come to the fore in recent years in social policy analysis to highlight the importance of subjective experiences in informing empirical enquiries. Through 'lived experience', researchers can not only respond to peoples' experiences, but they can also relate to how people live through and respond to certain experiences (Boylorn, 2008; McIntosh and Wright, 2019). Since one of the co-authors of this article is based in Mumbai, India, we were in the fortunate position to get a sense of what it means to live through the changes this pandemic has brought about, including how people experience and cope with effects triggered by the actions of the different actors involved in responding to this crisis.

The next section presents the case study material starting with a short history of pandemics followed by a timeline detailing how the pandemic unfolded in Mumbai before moving on to the discussion section.

## V. The Case Study

### 1 Background: A Short History of Pandemics in Maharashtra

To better understand India's response to COVID-19, it is worth reflecting on how the country has managed pandemics in the past. Maharashtra and Mumbai (Maharashtra's capital city) have a long history of pandemics, for example, frequent outbreaks of cholera (as early as 1820), plague (1896–97) and the Spanish Flu (1918–20). The plague of 1896–97 was the last significant pandemic Mumbai suffered from, and in order to suppress the plague, the colonial government at the time responded by making hospitalization of victims mandatory, by segregating contacts, by disinfecting houses that were plague-ridden, by inspecting travellers and detaining people who were suspected to be infected and by stopping any inflow of visitors from overseas (Klein, 1988; Sarkar, 2001). These measures were violently detested by the Indian population who tried to circumvent many of these measures, especially forced hospitalization and segregation (Klein, 1988; Sarkar, 2001). The plague outbreak in 1896–97 saw 1,000 deaths per month in Mumbai alone which led to an exodus from the city, thus spreading the disease further to other parts of India. The colonial government felt it had no choice but to install 'secondary and tertiary perimeters of defense' (Klein, 1988: 743) where inspection stations were established to screen people leaving the city, and if infected, they were forcibly removed from trains and other modes of transport and hospitalized (Sarkar, 2001). The Indian population lived in fear and opposed these measures; Ramanna (2012) notes that the 'people were more troubled by the measures to repress it [the plague] than by the epidemic itself' (p. 12). Violence and street fighting scenes became a daily occurrence. To prevent further escalations and to control the population and thereby the disease, the colonial government decided to make use of the military, for example, using Sepoy regiments where available, searching for plague victims in a manner that looked very much like a surprise military raid (Klein, 1988: 745; Sarkar, 2001). These actions were justified under the 1897 established 'Epidemic Diseases Act', which gave the government the power to enact special measures, prescribe regulations and impose penalties to combat pandemics (Government of India, 1897). The government's response to the Spanish Flu in 1918 did not look much different. The 1897 'Epidemic Diseases Act' was invoked to isolate and forcibly hospitalize victims of the disease. Where necessary, force was used to enact these measures. The use of force and the application of military metaphors in the context of diseases is not new and dates back as far as the first cholera pandemics in the early 19th century, which coincided with a decisive phase of British expansion in India (Arnold, 1986).

Reflecting on crisis management under British Rule where the fight against diseases reaching the scale of pandemics was often conducted like a military campaign to defend civilians (Arnold, 1986; Klein, 1988; Sarkar, 2001), it is striking to see how approach and language to crisis management have now changed. Originally, crisis management was in the domain of the military that sought to defend civilians from a particular threat, a famine, a drought or a health crisis (Alexander, 2002). However, crisis management has gradually evolved moving away from using force to control the population to collaborating and sharing of information to protect the population (Masri and Moore, 1995). This change was due to a realization that more flexible and adaptive approaches were better suited to responding to the multifaceted and complex realities of crises (Alexander, 2002). Hence, a wider range of actors got involved in emergency planning and preparedness, that is,

central and local governments alongside civil society organizations, businesses, etc., seeking to protect rather than defend civilians from a threat.

## VI. COVID-19: Mumbai's Experience

These changes in how crises are managed today can be usefully illustrated focussing on the response to COVID-19 in Mumbai. The first confirmed case of COVID-19 in Maharashtra was reported on 9 March 2020 in Pune, when a couple with travel history tested positive. From then onwards, the number of COVID-19 cases spread rapidly in Maharashtra, with Mumbai having had its first positive cases on 11 March 2020. Hence, our case study focusses on the time period 11 March to 9 September 2020, which falls within the first wave of the pandemic.

Maharashtra was one of the worst affected states in India in relation to COVID-19 infection rates (Figure 2), and the state's capital city Mumbai including its wider metropolitan region was one of the worst affected cities in India with more than 100,000 recorded COVID-19 cases and 6,000 deaths (*The Financial Times*, 2020, 29 July) suggesting that more than half of the population living in Mumbai's slums may have had COVID-19 already and are more like to get infected by the disease (Malani et al., 2020). These figures may not be surprising, Mumbai is a city with a great deal of inequality in terms of income, living conditions and access to basic services including education and healthcare. These inequalities have been mirrored in how the pandemic has impacted the city. There is clear difference in who has been hit the hardest by the crisis. Those already vulnerable have been in the worst position, both in terms of at risk of getting the virus, but also in terms of living in crowded conditions during lockdown, in terms of losing their income and in accessing healthcare facilities. Not only do poor people live in much smaller and cramped conditions, but the lockdown was also monitored more harshly in these areas (*BBC News*, 2020a, 2020d; *NDTV*, 2020b; Scroll, 2020a). Thus, these inequalities

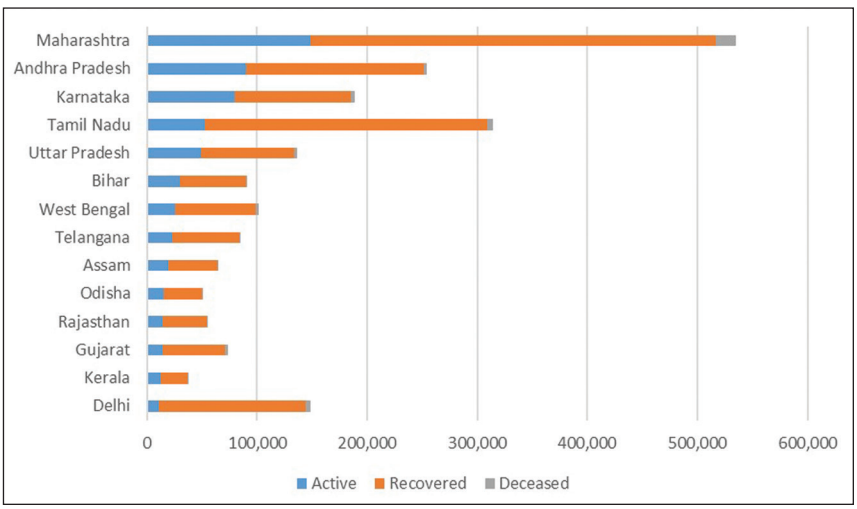


**Figure 2.** Number of COVID-19 Cases Across India's 14 Most Affected States and Union Territories

**Source:** State bulletins, COVID-19 Tracker India, data as of 12 August 2020. https://www.statista.com/statistics/1103458/india-novel-coronavirus-covid-19-cases-by-state/

led to the crisis affecting the poor disproportionately and further reinforcing it.

To deal with the rapidly spreading COVID-19 outbreak, many Indian states such as Karnataka, Haryana, Delhi and Goa invoked the 123-year old 'Epidemic Diseases Act' of 1897, the Government of Maharashtra (GMH) did so too on 13 March 2020, and at the same time, they set up a high-level committee to oversee and mobilize additional resources to be able to deal with COVID-19 (Quartz India, 2020). Table 1[2] summarizes the sequence of events in responding to COVID-19 in Maharashtra and Mumbai focussing on the actors involved and the types of their responses. It is worth noting that some actors such as GOI may impose responses or invoke legislation to cope with the crisis, but the implementation is often left to other actors such as state or local governments or NPOs, etc.; for example, the nation-wide 21-day lockdown announced on 24 March 2020 by the Prime Minister (PM) of India was then implemented by the state government

**Table 1.** Timeline of Events

| *Date* | *Type of response* | *Who was involved* |
|---|---|---|
| 13 March 2020 | The 'Epidemic Diseases Act' of 1897 was invoked to enable the state to hospitalize individuals with symptoms. Cinema theatres, sport centres and malls were closed as a precaution.<br>A committee of high-level ministers and civil servants was constituted to work on a COVID-19 mitigation strategy. | GMH* |
| 18 March 2020 | BMC announced that shops would remain open only on alternate days as a first step towards ensuring social distancing. | BMC |
| 20 March 2020 | GMH's chief minister (CM) declared that all offices other than those deemed essential services needed to remain shut until end of the month, and people were urged to stay at home. | GMH |
| 22 March 2020 | CM declared that Section 144 of the Criminal Procedure Code would be imposed with effect from the following day with the aim to prohibit people's movements except for emergencies. | GMH |
| 23 March 2020 | CM announced the closure of district borders and a state-wide curfew, starting the lockdown in Mumbai and the rest of the state. | GMH |
| 24 March 2020 | PM announced a 21-day nation-wide lockdown which entailed a ban on leaving home apart from emergencies and for getting food and essentials; all shops other than pharmacies and super markets were shut; all commercial and private establishments and companies were shut with mandatory work from home (only banks remained open); all educational institutions were shut; all places of worship were shut; all public transport was initially shut and after some time, all non-essential public and private transport was shut; all social, political, sports, entertainment, academic, cultural and religious activities were prohibited. | GOI but implemented by GMH and BMC |

*(Table 1 continued)*

*(Table 1 continued)*

| *Date* | *Type of response* | *Who was involved* |
|---|---|---|
| 29 March 2020 | Standard operating procedures to be followed by all healthcare facilities with respect to COVID-19 were released. | GMH |
| End of March 2020 | Financial packages for food and shelter of migrants and a large number of relief camps were set up.<br>Many of these shelters and soup kitchens were operated by NPOs, private enterprises and private citizens.<br>The shortage of personal protective equipment triggered efforts by the private sector to rejig their manufacturing capacities to produce face masks, face shields, personal protective equipment, etc. | GMH, NPOs, private enterprises and citizens |
| 8 April 2020 | BMC made the wearing of facemasks compulsory in public places in Mumbai. | BMC |
| 10 April 2020 | In response to a deluge of false information, a Prohibitory Order banning the dissemination of incorrect, derogatory or discriminatory messages through text and WhatsApp messages or social media platforms was released. | Commissioner of Police of Greater Mumbai |
| 11 April 2020 | Maharashtra's CM announced that the lockdown in the state would be extended until the end of April. Shramik special trains were organized to bring migrant workers back to their homes.<br>NPOs and private citizens were engaged in tackling the migrant crisis ensuing from the lockdown measures. | GMH, NPOs and citizens |
| Mid-April 2020 | Upgrading of hospitals and designating hospitals as special COVID-19 ones. Setting up of quarantine facilities.<br>Private enterprises supported the government in upgrading health facilities. Ola and Uber taxi operators supported getting health workers to and from work. | GMH and BMC private enterprises |
| 14 April 2020 | PM further extended the lockdown to 3 May 2020. | GOI |
| 1 May 2020 | PM announced further extended the lockdown to 17 May 2020 and further to 31 May 2020. | GOI |
| 30 May 2020 | PM announced easing of the lockdown in many parts of the country. However, the lockdown continued in Mumbai, given the continued rapid rise in COVID-19 numbers. | GOI |

**Sources:** *BBC News* (2020a); *Business Standard* (2020); Das and Pardeshi (2020); *Indian Express* (2020a); *The Wire* (2020); Scroll (2020a).
**Note:** * GOI = Government of India; GMH = State Government of Maharashtra; BMC = Brihanmumbai Municipal Corporation; NPO = non-profit organization.

(which manages policing) and the Brihanmumbai Municipal Corporation (BMC)[3]—Mumbai's local government. The BMC, for example, began putting 1-m markers outside shops to denote social distanced queuing (*The Hindu*, 2020). At the same time, the Mumbai police which was in charge of ensuring compliance, set up check-posts across the city, and began using

vehicles such as autorickshaws with speakers to spread awareness and warnings about the lockdown, as well as using security cameras and drones to patrol high-density areas such as the many crowded informal settlements in the city (*NDTV*, 2020b). BMC would also declare certain areas in the city, ranging from a building to a street or a whole locality, which had positive COVID-19 cases as 'containment zones' which were sealed off and issued with a curfew with no option to leave that zone or enter it (*MumbaiLive*, 2020). We discuss these multiple layers of response between and across actors in more detail further below.

As a result of the nation-wide lockdown, supply-chains were initially disrupted because wholesale markets were shut and transport of goods even from within states became a challenge, and initially, grocery shops ran low on fresh food, with few vegetable vendors on the streets, while the population tried to stock up (Mid-day, 2020a, 2020b, 2020c). This resulted in long queues to buy groceries and concerns over social distancing grew. Employers were asked by GOI and GMH to continue to pay salaries to both casual and permanent workers (Scroll, 2020b). However, that stopped quickly in the informal and construction sectors, and a lot of day labourers—many of them migrants—quickly found themselves in a difficult situation with no access to food or with no money to buy food. At the same time, borders were closed and there was no public or private transport. The result was a desperate need for delivery of food and essential items and the provision of shelters within Mumbai, as well as the start of a wave of internal migration back to villages in Maharashtra and beyond, often on foot (*BBC News*, 2020b, 2020c). In this context, the rising involvement of additional non-governmental actors such as NPOs and citizens can be seen (*BBC News*, 2020c; Das and Pardeshi, 2020; *Indian Express*, 2020a, 2020b; Mint, 2020c). They responded in areas where the government was limited in its reach, or where relief was urgently required.

A few weeks into lockdown, Mumbai's healthcare facilities began feeling the strain as there was a lack of infrastructure to deal effectively with the COVID-19 pandemic (Scroll, 2020a). The result was an initially high number of fatalities. The healthcare sector had competing priorities that needed attention—from a lack of adequate infrastructure that needed to be put in place and upgraded quickly including establishing a contract tracing system from scratch, to staff not turning up to work, to a shortage of protective equipment and testing kits, to citizens being turned away from hospitals for treatment (*BBC News*, 2020; Malani et al., 2020; Mint, 2020a). BMC and GMH in Mumbai reacted to these challenges by upgrading hospitals and classifying some as COVID-19 hospitals. They also opened previously closed hospitals which were then designated as COVID-19 hospitals and equipped them with specialist equipment. Private hospitals were ordered by GMH to cooperate and provide COVID-19 treatment requiring them to give up 80% of their beds to be run under the government, as well as establishing a pricing list for both COVID-19 and non-COVID-19 healthcare services to avoid predatory pricing (*BBC News*, 2020; Mint, 2020a; Scroll, 2020a). At the same time, a vast number of quarantine facilities were set up in large open spaces, in temporarily unused buildings such as schools, in the local Nehru Planetarium and sport arenas as well as in hotels (whose regular operations were shut) where COVID-19 patients with mild symptoms as well as those at risk of COVID-19 transmission (such as close family members) would have to stay in quarantine (Mint, 2020a; *NDTV*, 2020a). These hotels were later also used as quarantine facilities for travellers. There were initial issues with people not wanting to stay in quarantine facilities or trying to avoid getting tested, something not too dissimilar to the reactions of people affected by the response of the colonial government to the Great Plague in 1896–97.

As the lockdown persisted, the economic fallout from the lockdown and the pandemic became evident, with businesses at the risk of

shutting down permanently and individuals losing their jobs and income. Individuals with jobs in the informal sector, for example, drivers, maids, cleaners or those working in restaurants or for themselves in micro units, were hit the hardest (Mint, 2020b). At the same time, the fallout from the lockdown also led to an increase in domestic violence and worries about poor children, especially young girls, losing out on years of schooling with much higher risks of early or child marriage (United Nations, 2020). This pandemic did not only cause one crisis, but it unfolded in a way that caused multiple crises. The initial fear of the spread of the virus overloading the healthcare system in Maharashtra resulted in the early lockdown in March (Das and Pardeshi, 2020). The aim was then to contain the virus and to buy time to upgrade the healthcare infrastructure that was in poor shape. However, the locking down of a large part of the labour force that was both informal and vulnerable to shocks—day labourers and temporary workers—that often resided in the city temporarily resulted in another crisis (*BBC News*, 2020d; Mint, 2020b). These individuals ran out of food and money and needed to return home, but returning home was not an option with all public transport shut; hence, many then began to walk leading to India's largest internal migration since partition (*Guardian*, 2020). Suddenly, GMH had several crises on their hands—first a health crisis, followed by a day labourer and, subsequently, a migrant crisis. This was soon followed by another, economic, crisis as large parts of economic activity could not be sustained during the pandemic. These multiple crises triggered a response by the government, alongside which a rapidly growing and multifaceted response by NPOs (Das and Pardeshi, 2020; *Indian Express*, 2020b), individual citizens (*BBC News*, 2020c; *India Today*, 2020a; Mint, 2020c) and private enterprises (*India Today*, 2020b) could be observed with the objective to provide relief for day labourers, stranded migrants and others in need of food and shelter. The next section discusses this response in more detail.

## VII. Discussion: A Complex Systems Analysis of the Pandemic in Mumbai

*1 The Actors: Multiple Levels of Response*

Multiple actors were involved in responding to the COVID-19 pandemic, each had different roles to play and different agendas, networks and relationships to navigate. The response to the crisis was multifaceted and collaborative alluding to the complex and systemic nature of the COVID-19 pandemic. This section discusses the various actors and their engagement with each other and how they collaborated in unusual circumstances viewed through the lens of a complex systems thinking framework.

*2 Government*

The government policy's response to the crisis took place on three interconnected but distinct levels: GOI, GHM and BMC. Adding to the complexity, GOI is dominated by the Bharatiya Janata Party (BJP) while GMH is run by an opposition coalition with Shiv Sena[4] at the helm, which is also in charge of BMC. Furthermore, the Mumbai Metropolitan Area (or greater Mumbai) has three distinct local governments (as described in footnote 3), further complicating coordination issues. While the decisions by GOI would override the decisions by GMH and BMC, it was GMH and BMC that implemented decisions in Mumbai through their representatives in the different wards (districts) of the city. A major challenge for the government entities were the multiple urgent priorities that the multiple crises we discussed above created. The focus on containing the spread of the virus caused a migrant and humanitarian crisis and later an economic crisis. There was an urgent need to improve healthcare infrastructure. However, at the same time, ensuring food supply was a challenge. The administration had to continuously adapt and find a new solution often with scarce funding available, and prioritize among a long list of urgent tasks. This is the context in which the growing role of NPOs in responding to this pandemic should be seen.

*3 Non-profit Organizations*

NPOs were the actors that were able to respond most quickly to the unfolding migrant and humanitarian crisis. They used their ability to mobilize communities quickly and capitalized on their experience working with vulnerable communities to rapidly assess the situation locally and respond with shelter, food packages, sanitation kits, water and other necessities. This initial relief work focussed on providing food and essentials to poor communities; it later involved working with migrant communities as well arranging transport to get migrants home. Furthermore, the traditional funders of NPOs—the foundations, corporate social responsibility departments of private enterprises and individual donors—converted their programmes to provide funding for relief operations. New forms of fund raising were also developed such as online donation portals allowing the rapid mobilization of funds.

*4 Citizens*

At the same time, private citizens responded to the crisis by organizing themselves online to coordinate fundraising and relief efforts. They also had their feet on the ground forming neighbourhood groups to distribute masks and food, and famous Bollywood actors embarked on large-scale relief efforts for day labourers and migrant workers providing food, shelter and subsequently transport helping them to travel home.

*5 Private Enterprises*

Mumbai has a large private sector as it is India's financial and business capital. The operations of many private enterprises were severely affected as offices shut down and staff had to work from home; thus, working practices had to change significantly and rapidly to account for this sudden move online. At the same time, private enterprises began to participate in relief work. Some operated shelters and soup kitchens for poor individuals, while others embarked on making face shields for healthcare staff. Some manufacturing enterprises repurposed their factory floors to produce personal protective equipment, face masks and other specialist equipment for hospitals; for example, the Mahindra Group used their Research & Development facilities to create and produce new low-cost ventilators. Large networks of funders began raising funds for the development of a vaccine. Other private enterprises such as cab aggregators Ola and Uber began driving essential workers around the city. Hotels that were closed began offering their rooms to healthcare workers and other essential workers who were unable to live at home or needed to be closer to work, thus supporting the government in their efforts to combat the pandemic.

## VIII. Networks and Partnerships

Strong networks and partnerships are a prerequisite for information and knowledge to flow between actors in a system. Often individuals (as opposed to organizations more broadly) and their linkages to others are crucial for the formation of new networks and partnerships. In the case of Mumbai, we see this in the way individuals came together as individual citizens, as leaders of NPOs, as volunteers from the private sector and as representatives of GMH and BMC to address this crisis; for example, individuals began organizing themselves into networks and enabling aid to flow to migrants and day labourers. This involvement has taken several forms:

1. It included citizens working with existing NPOs to expand the teams that hand out essentials, and providing food and shelter;
2. it included starting up collaborations between BMC, GMH and NPOs to coordinate the relief effort on the ground, in particular with respect to working with poor and marginalized communities that NPOs already had experience engaging with;
3. it involved organizing funding and the logistics of collecting essentials for existing organizations;

4. it involved starting up new networks and organizations for the explicit purpose of reacting to the pandemic and the need for additional relief efforts;
5. it involved individual citizens engaging in loosely formed online networks to coordinate direct relief where needed in the city, working with NPOs and local government; and
6. it involved individual citizens undertaking their own individual efforts, such as cooking food and delivering it to people in need stranded nearby, providing funding to those in the neighbourhood and supporting their maids, cooks or drivers who no longer had a source of income.

These newly formed networks and partnerships between different actors were active in online and offline modes, with offline modes helping to direct efforts on the ground, and spreading awareness, while online fundraising platforms made it easy for organizations to announce requests allowing citizens to respond. Communication apps such as WhatsApp have been vital in coordinating efforts, made easier by a well-functioning mobile network and the popularity of WhatsApp among a wide range of social groups.

Individual citizens' newly formed networks and NPOs, on the one hand, and BMC and GMH and its agencies, on the other hand, appear to have found complementary ways of working. While NPOs and citizen groups were quick to react, the public sector often moved more slowly. This may be due to NPO's long history of working in the most affected low-income urban areas as well as their pre-existing networks which are built on solid foundations of trust. The public sector would often take longer to respond, which is not surprising as the different government entities sit at the core of the system (as discussed in the theory section) with multiple layers of administration to negotiate and competing priorities to manage. However, when the government does respond, it appears to have a greater impact than NPOs and citizens.

## IX. Knowledge and Information Sharing

In the response to COVID-19 and to facilitate knowledge and information sharing across the various actors, both traditional and social media played an important part as knowledge brokers and information sharers with continuous reporting on the pandemic, including the latest restrictions. This, however, has occasionally also led to misinformation and fearmongering, for example WhatsApp messages going viral on the spread of COVID-19, or news media whipping up fear.

The way knowledge and information is shared within the system and how feedback loops play out within and between actors affects how learning occurs and how actors are able to respond and react to challenges. In the context of this pandemic, several forms of knowledge and information flows occurred. For example, the government shared information with citizens, private enterprises and NPOs, including daily status updates, regular video addresses CM via social media and TV, frequent press releases and on-the-ground awareness raising (driving around in vehicles with loudspeakers) by civil servants at state and BMC level.

Traditional media—TV, radio and online newspapers (offline newspaper distribution was prohibited during lockdown)—provided daily updates on the spread of COVID-19 and on the policies put in place by the local and state governments. In addition, social media was used both by citizens and the government to not only share information about the spread of COVID-19 but also request disaster relief for different localities and to appeal for help and funding. Lastly, citizen-to-citizen information sharing at various levels took place—word of mouth between families and friends, within housing societies or among employees and broadcasts to larger groups to self-organize fundraising and relief efforts.

Coordination of responses to a crisis situation is significantly enhanced by the ease with which knowledge and information flows. Feedback loops and information sharing can

lead to improved responses as actors in the system have more information on which to act. This is evident, for example, in the way the government, NPOs and citizens were able to respond to the crisis, as well as inform one another through, for example, social media channels, such as Twitter, where they could connect with GMH and BMC representatives including senior GMH politicians, through tweets.

On the other hand, knowledge and information flows as well as feedback loops can have negative effects when they work poorly, that is, sometimes, slow filtering down of news about updated regulatory and policy decisions from the decision-makers at the top to the implementers at the local level (including local level officials, neighbourhood police, or hospital management) meant that the implementation of those changes was hampered leading to confusion and a lack of clarity in the meantime; for example, when the government allowed individuals to move outside to buy food, they would still get into trouble with local police, or trucks carrying food and essential goods struggled to get through check posts, even though they should have been allowed to pass, thus disrupting the supply-chain, affecting wholesale markets and causing a shortage of food and essentials in the city. However, knowledge and information flows as well as feedback loops improved over time.

## X. Hard and Soft Institutions

Finally, we take a look at hard and soft institutions as they govern the way actors relate to each other within the system. Institutions influence the way actors behave and knowledge flows within a system. Hard institutions include the three levels of government that we described above, that is, GOI, GMH and BMC, and their rules and regulations which applied to Mumbai during this pandemic. Soft institutions are the habits and practices shaped by traditions and culture that shape reactions and actions of the various actors that are linked within a system. This includes, for example, the way citizens respond to the need for social distancing to reduce the spread of the virus, and the level of monitoring and policing required to enforce the lockdown. Social distancing often proved difficult in public spaces, which resulted in lockdown as well as in the requirement to wear masks. However, by and large, the citizens of Mumbai have been compliant with the lockdown and crisis response measures imposed by the government, likely because of well-functioning institutions.

## XI. Conclusion

In this article, we employed a systems thinking approach to better understand how the response to COVID-19 in Mumbai played out by focussing on the first wave of the pandemic (11 March to 9 September 2020) and acknowledging that India's COVID-19 crisis is far from over; for example, the second wave, which began in March 2021, saw a dramatic rise in infections putting relentless pressure on India's public health system leading to the involvement of a range of new actors like international donors and foreign governments, which yields additional insights from a systems perspective, but this is beyond the scope of this article.

Analysing the first wave of COVID-19, we find a large network of multiple actors, that is, government agencies, NPOs, private enterprises and citizens, which were interrelated in various ways. Existing networks and partnerships among these actors were important, but given the unique nature of the current pandemic, new partnerships were formed, and new modes of knowledge and information sharing were explored, like the extensive use of social media and WhatsApp.

We find that the various actors involved in responding to this crisis had to continuously adapt, innovate and find new solutions, often with scarce funding available, and they had to prioritize among a long list of urgent tasks.

With regard to more specific lessons learnt, first, we find that rapidly expanding the public sector healthcare infrastructure by improving and upgrading existing infrastructure and

setting up new temporary structures like the BKC Jumbo Covid-19 Centre was incredibly important. Doing so whilst also making the decision (by GMH) to take over control of 80% of private hospital beds in the state as well as to put in place caps on pricing of services and medical supplies ensured that private sector healthcare providers cooperated.

Second, throughout the first wave, NPOs played an important role in relief work at the community level. By having nimble operations, and using their existing grassroots connections, they were able to quickly pivot their operations to provide relief of various kinds during the pandemic. While the scale of government reach is much larger, NPOs were faster in their ability to react and configure to respond to the crisis. The BMC and GMH working closely with NPOs therefore enabled a rapid response in specific geographies (e.g., Dharavi) or on specific issues (e.g., migrant crisis) that could be scaled up over time.

Third, ensuring good feedback loops between different parts of the system was vital in tackling multiple crises at the same time. Daily announcements on social media (via Facebook and Twitter) as well as regular broadcasts and interviews with representatives of BMC and GMH ensured that citizens were aware of the latest updates on caseloads, spread of the virus and any precautionary measures that were put in place, like lockdowns. Social media became an important channel to communicate updates and issues from different parts of the city by citizens and NPOs; for example, when supply-chains were disrupted in the early days of the lockdown due to a lack of clarity on the different rules across the various districts, citizens were able to voice their concerns on social media and engage with BMC directly. News media followed up on citizen complaints, and government acted on feedback to eventually ensure smoother supply-chains and distribution of goods.

Fourth, recognizing that not all parts of the system always move in the same way at the same time, Maharashtra took a decentralized approach which allowed decision-making closer to the ground and adjusted to the local context. While the broader framework of lockdown management was laid down by GOI and GMH, it was to a large extent BMC that took decisions on a day-to-day basis on handling the crisis in Mumbai. Even within the city, there were distinct differences between different wards depending on the rate of infected citizens and the available infrastructure and housing context; for example, densely populated neighbourhoods of the city, including its informal settlements, employed strategies such as door-to-door testing and mandatory quarantine in purpose-built facilities for COVID-19 infected individuals as well as their family members. Likewise, whole housing complexes were declared containment zones with very strict measures in place when there were too many COVID-19 cases. However, in less densely populated areas with fewer COVID-19 infections, there was no regular testing and very few resources devoted to monitoring the situation. Citizens in these areas also did not experience many restrictions in terms of moving around within the neighbourhood. Since the first wave of COVID-19, this decentralized approach has been further strengthened, with each ward in the city having set up its own *War Room*, as a first port of call for citizens. The *War Room* teams monitor caseloads, check availability of testing facilities and medical beds as well as monitor other infrastructure in the ward. They also assess COVID-19 infected individuals as to whether they could remain at home or would need to be taken to a hospital or any other healthcare facility for further treatment (*The Hindu*, 2021).

Finally, we conclude that a multifaceted and evolutionary response integrating a multitude of players is the most effective response mode to a crisis of this scale. The lessons learnt from the crisis management observed in Mumbai will hopefully have implications for how best to deal with future crises—health, economic or climate change related—in complex developing country contexts. Unlike any other event

before, COVID-19 has demonstrated that decisions made to deal with one crisis, that is, COVID-19, may lead to other secondary and tertiary crises which we suggest should be considered from a systems thinking approach to allow the optimal response mode to a crisis.

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## Notes

1. Based on Davenport and Prusak (1998), we understand information to mean data that have been contextualised, categorized, calculated and condensed, while knowledge refers to know-how and insights based on understanding, experience and context.
2. While Table 1 and the case study briefly summarize the key events and actions during the first two months of the COVID-19 crisis, we recognize that a lot of additional activities, processes and engagements were underway concurrently, which we are unable to include in this article due to space constraints.
3. BMC is translated as the Corporation of Greater Mumbai. It should be noted that while we discuss the role of BMC here primarily, Greater Mumbai is part of the larger Mumbai Metropolitan Region (MMR) which incorporates a number of local government bodies for neighbouring areas, including the Municipal Corporations of Thane, The Kalyan-Dombivli, Navi Mumbai, Panvel, Vasai-Virar, Mira-Bhayandar, Bhiwandi-Nizampur, Ulhasnagar. MMR has a dedicated GMH organization, that is, Mumbai Metropolitan Region Development Authority (MMRDA), overseeing urban development including transport and housing.
4. Shiv Sena is a Maharashtrian regional party founded by Bal Thackeray. The other coalition partners are the regional National Congress Party and the Congress.

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